Quintus™ 5-part hematology system

Regular maintenance maximizes uptime and ensures a reliable instrument performance

Quintus 5-part hematology system brings together a high-quality instrument with integrated workstation, easy-to handle reagents, and a user-friendly interface (Fig 1). The system provides results for 26 parameters, with histograms and scattergrams for the blood cell count (Fig 2). The operator is alerted in case of abnormal parameter results, and special flags are shown upon detection of immature or atypical cells. With its compact design, the analyzer is well-suited for laboratories with limited space.

To ensure consistent functioning and maximized productivity of the analyzer, it is recommended to pay special attention to determined maintenance procedures and service schedules. This document highlights instrument components that are critical for the Quintus analyzer to provide diagnostic value. Approaches for optimized maintenance to ensure maximized lifetime of your instrument are discussed.

Introduction

Hematology, the study of blood, dates back to the ancient Egypt and the practice of bloodletting. However, a major breakthrough was found in the 1670's with the development of a high-magnification microscope by Antonie van Leeuwenhoek. Today, a blood cell count is frequently requested by physicians to evaluate patients' blood status and, for this, automated hematology analyzers are typically used.

As with microscopy, hematology analyzers are predominantly used for a complete blood count (CBC) of the oxygen-carrying red blood cells (RBC), the platelets (PLT) that help clot the blood, and the white blood cells (WBC) of the immune system. In addition, an automated analyzer also measures the oxygen-containing hemoglobin (HGB) and determines a range of other parameters such as the mean cell volume (MCV), PLT distribution width (PDW), and hematocrit (HCT), that is, the red blood cell-to-plasma ratio. Hence, an automated analyzer can provide much more information than a manual count.

Over the last years, the market of hematology analyzers has witnessed a significant growth, not only due to the increased demand for this type of analyses. Driving factors also include technical improvements in terms of analytical capabilities and simplified operations. In addition to a CBC, modern analyzers also differentiate the WBCs into their five subpopulations neutrophils (NEU), lymphocytes (LYM), monocytes (MONO), eosinophils (EOS), and basophils (BASO). However, with the development of more advanced instrument comes increased technical complexity. Analyzer that can provide this level of detail are typically based on several measurement techniques.

Fig 1. Quintus 5-part hematology analyzer equipped with optional autoloader unit.

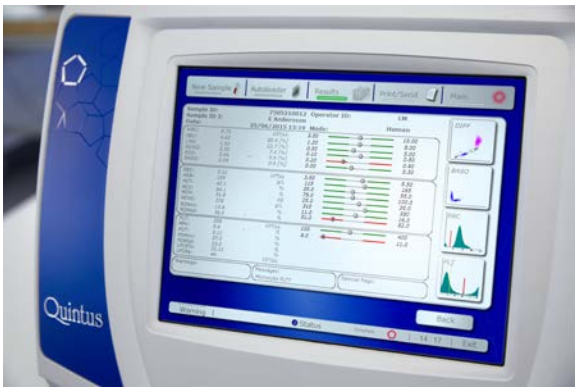

Fig 2. The large touchscreen of the Quintus analyzer provides plenty of room to display all 26-parameter results together with scattergrams, histograms, and system messages.

From accurate sampling to reliable results

Quintus hematology system is designed for accurate and reliable performance. The sampling system enables correct aspiration and dilution of the sample. Lyse reagent composition and lysis time are tailored to provide precise treatment of cells prior to analysis. The pump system ensures an exact balance between pressure and vacuum for an accurate flow across the instrument.

Results from Quintus hematology system is in well agreement with reference system (Fig 3).

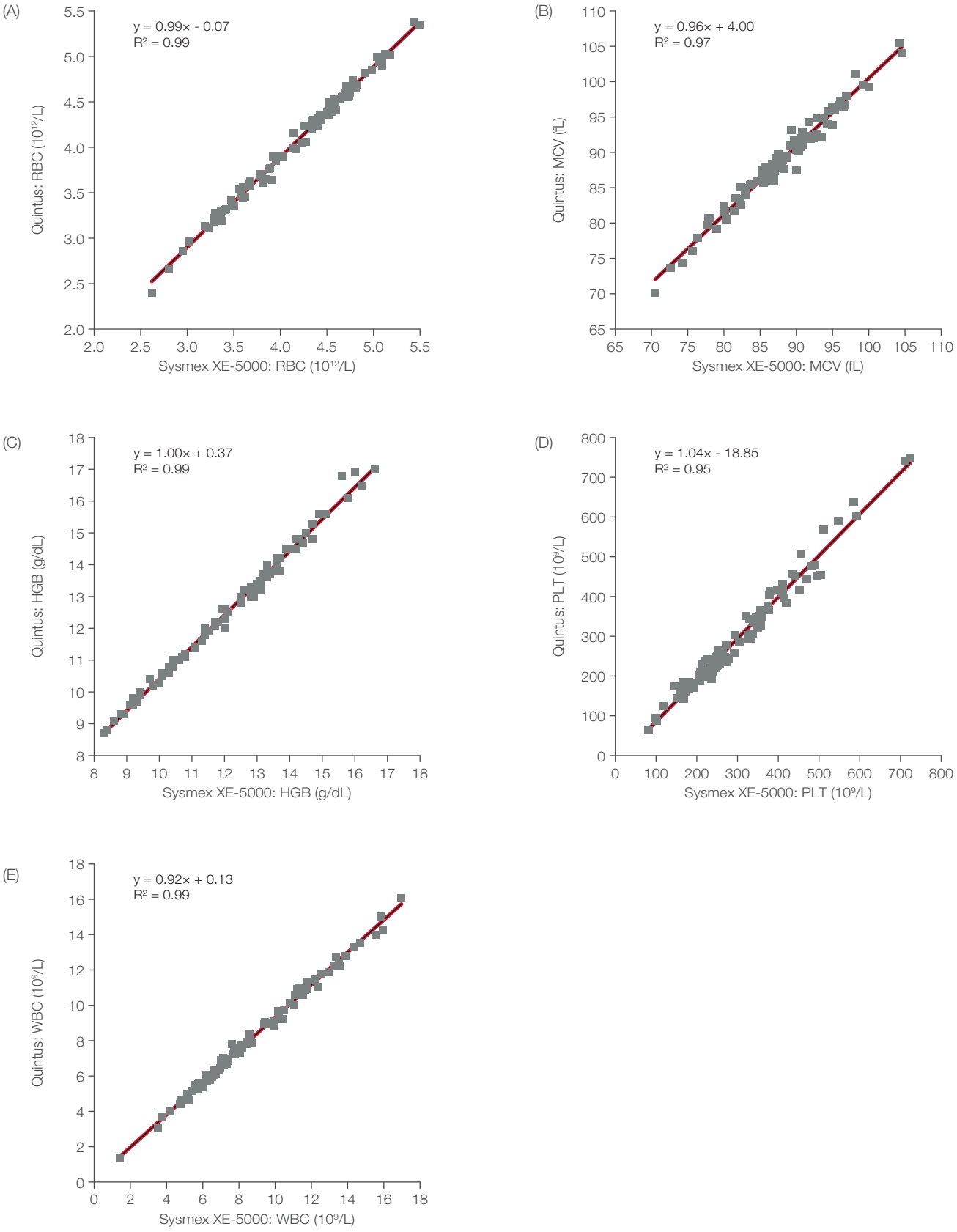

Fig 3. Correlation between Quintus and Sysmex™ XE-5000 5-part hematology analyzer. In regression plots, the black line corresponds to identity (x = y) and the red line corresponds to best fit.

Measurement technologies

Quintus hematology analyzer uses impedance technology for total WBC, RBC and PLT counts. As illustrated in Figure 4, each cell passing through the aperture causes a drop in the electrical current (a pulse). The number of generated pulses correlates with the number of cells, whereas the size of the pulse is related to the cell size.

To determine HGB concentration, the reagent lyses the RBCs so that HGB is released and can be measured spectrophotometrically as illustrated in Figure 5.

To provide the 5-part differentiation of the WBC, the analyzer uses laser-based flow cytometry (Fig 6). With this technique, cells are forced to flow in a single file through the aperture by a sheath fluid, created by a fast-moving diluent that surrounds the slow-moving sample. A laser beam is passed through the sample, and when a cell passes through the sensing zone, the light is scattered and measured by a photoconductor that converts the light into an electrical impulse. The number of generated impulses correlates with the number of cells, whereas the light scatter is used to determine cell granularity, shape, and size.

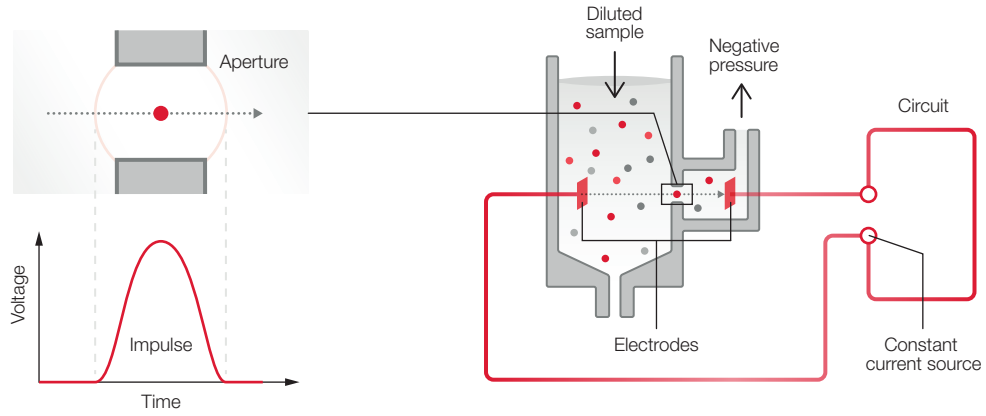

Fig 4. The principle for measuring changes in the electrical impedance produced by a cell passing through an aperture.

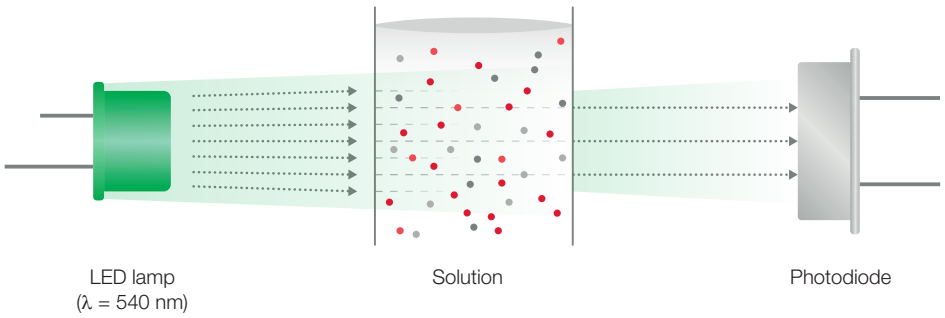

Fig 5. HGB concentration is measured by spectrophotometry and calculated as a difference of a blank and a blood measure with and without illumination to reduce the effect of liquid refraction and disturbing light.

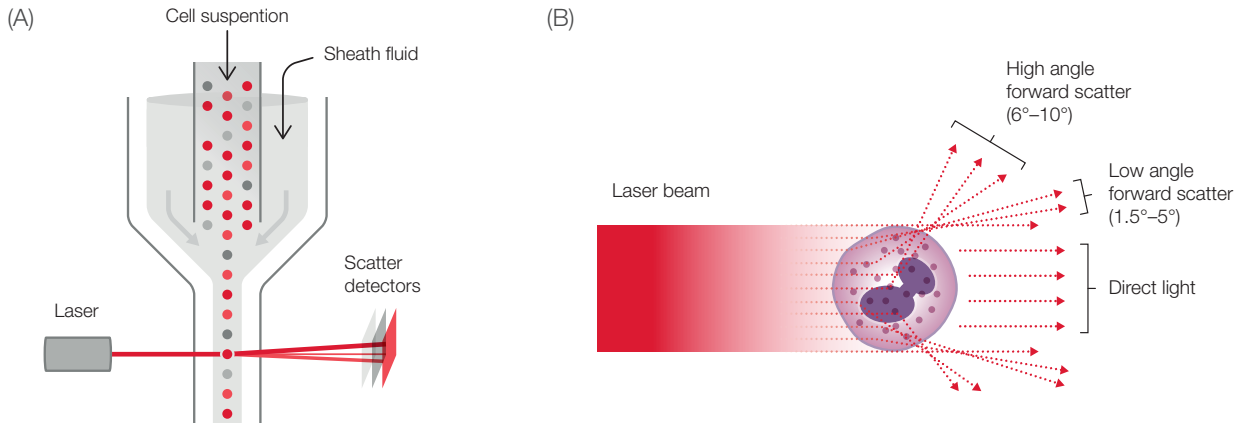

Fig 6. (A) Laser-based flow cytometry for 5-part differential of white blood cells. (B) Laser-scatter method, where the low-angle signal provides information about the size and the high-angle signal provides information about the internal cell structure.

System components

Reagents

Only three reagents are required for the Quintus analyzer—Diluent, cyanide-free Lyse, and Stopper—which greatly facilitates handling and logistics and helps reduce running costs. Simply scan the barcode on the reagent container and the analyzer stores key information such as lot number, open and expiry dates. Each reagent is color-coded, and current status is viewable by touching the lower section of the instrument display. The measurement principle is depicted in Figure 7.

The use of the reagent kit supplied by Boule Diagnostics ensures analytical quality and performance of the instrument (Fig 8).

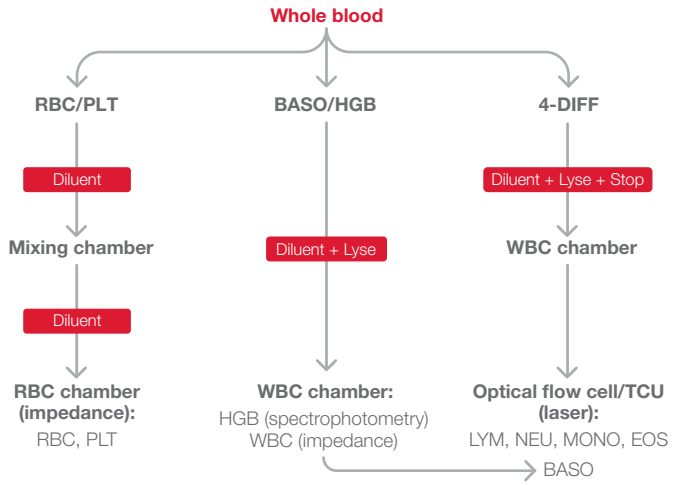

Fig 7. Quintus measurement principle (three cycles).

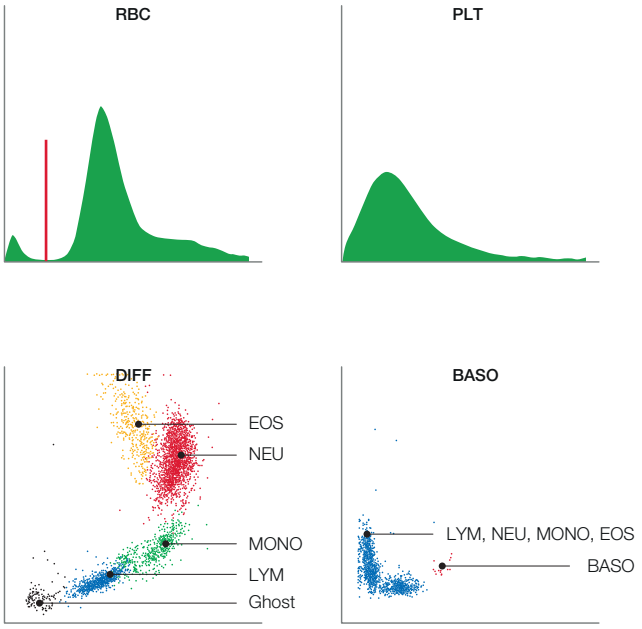

Fig 8. The Quintus hematology system provides results for 26 parameters, with histograms for RBC and PLT and scattergrams for the WBC differential.

Pump system

The Quintus analyzer is equipped with a high-quality vacuum pump designed to pump air at pressures below the atmospheric pressure. Vacuum trap and accessories are carefully selected to prevent the pump from corrosive vapors and particle fouling. Eight high-precision syringe pumps (dilutors) make sure sample aspiration and dilution are correct.

A faulty or worn-out pump can create flagged measurement errors, causing additional follow-up. It is therefore recommended that instrument maintenance procedures and service schedules are closely followed to ensure a trouble-free use of the analyzer.

Shear valve technology

The sampling technique is a critical part of the measurement and is reflected in the accuracy of every result. The Quintus analyzer comes equipped with a high-precision shear valve for precise collection of blood. To prevent malfunction during operation, it is recommended to clean the shear valve after every 1500 samples or every month to avoid salt build-up on the inner surface of the shear-valve.

Wash head

The wash head prevents carryover between samples by making sure the sample probe is clean. Any salt build-up on the lower surface that can cause malfunction during operation can be avoided by regular cleanings.

Pressure control system

The Quintus analyzer is equipped with pressure sensors that ensure equilibration of the pneumatic system. The lower port pressure sensor is equipped with a check valve to protect the pressure board from being subjected to any liquid. Following recommended maintenance procedures will ensure functionality of the check valve.

Optional autoloader

The Quintus autoloader is a compact, easy-to-use option for users who value letting their instrument get on with the analyses. The autoloader is a convenient walk-away solution for laboratories with high workloads. Just pre-load up to 10 × 10 samples and let the analyzer do the work. The autoloader reads sample barcode and tilts and rotates every tube to ensure proper mixing. Most standard closed EDTA tubes will fit the autoloader, and the cap is detected by a cap recognition sensor. Emergency samples can easily be analyzed in the middle of an automated run.

Although the mixer unit of the autoloader inverts each tube seven times before sampling, some blood samples can form tighter sediments during longer waiting time and therefore might be insufficiently mixed (e.g., samples with high erythrocyte sedimentation rate). To ensure accurate results, make sure that all sample tubes are mixed properly by manually inverting the tubes six to eight times immediately before loaded onto the autoloader and the batch measurement is started.

Table 1. Scheduled maintenance

Procedure	Description	Frequency (samples/day)		
		Less than 50	More than 50	More than 100
Overnight cleaning	1. Click ***Exit*** and then ***Shutdown*** or ***Overnight Clean***. Instructions will be given to place Boule Hypochlorite Cleaner solution into sample rotor. 2. RemFove cap from vial with Boule Hypochlorite Cleaner, place in the sample rotor and then press [OK]. 3. Clean outside of unit with soft cloth and DI water if needed.	Daily	Daily	Daily
Shear valve cleaning	Click ***Advance*** > ***Maintenance*** > ***Clean***, and select ***Shear Valve***. Follow instructions in Section 9.3 of the User manual.	Every month	Every 2 weeks	Every week
Wash head cleaning	Remove the wash head and clean with distilled water using gauze pads, soft, lint-free cloth or cotton swab. Refer to Section 9.3 of the User manual for more information			
Flow cell cleaning	Click ***Advance*** > ***Maintenance*** > ***Clean***, and select ***Flow Cell***.			
Hard cleaning	Click ***Advance*** > ***Maintenance*** > ***Clean***, and select ***Hard Clean***. Fill a tube with Boule Hypoclorite 4% and place it on the rotor.	Every 3 months	Every 2 months	Every month

Procedure	Description	Frequency
Instrument calibration	Follow instructions in Section 8 of the User manual.	Every 6 months (or according to local regulations)
Preventive maintenance (PM)	Performed by an authorized service technician: • Detailed functional inspection of the system. • Compulsory replacement of the parts included in the Boule Preventive Maintenance Kit. • Repair or replacement of additional parts as needed.	Every 2 years, or after 45 000 measurements from last mid-cycle maintenance, whichever is reached earlier.
Mid-cycle maintenance	Performed by an authorized service technician: • Detailed functional inspection of the system. • Repair or replacement of parts as needed.	One year after installation or after 45 000 measurement cycles, whichever is reached earlier. Thereafter, every 2 years, alternating PM, or after 45 000 measurements from the last PM, whichever is reached earlier.

The autoloader is easily connected by sliding the unit into the opening on the right-hand side of the analyzer until the clamp locks into place. Before installing the autoloader, make sure the guiding pins are clean and no dust is trapped in the corresponding holes to prevent damage to the sample probe. Upon installation, your authorized service engineer will ensure that the sample probe is correctly aligned.

For more information, refer to Section 2.5 of the User manual.

Quality control

Quintus hematology analyzer is part of Boule's Total Quality Concept that is designed to increase the value of reported hematology results. Controls and calibrator are key elements of this initiative. Boule QC materials (Boule Con-5Diff G2 and Boule Cal-5Diff G2) ensure that the Quintus analyzer performs accurately and delivers quality-controlled hematology results.

Like the reagents, the controls and calibrator use barcode scanning for secure handling and assay sheet registration to minimize the risk of error when manually entering reference values. Advanced quality control functions built into the Quintus software include Levey-Jennings charts, XB-function, and QC reports.

Instrument maintenance

Although the majority of the instrument cleaning procedures are automated to keep the user maintenance to an absolute minimum, some user intervention is still required. Section 9 in the User manual contains information on how to maintain the Quintus analyzer. An overview of maintenance procedures is given in Table 1.

Conclusion

With the ever-increasing demand for improved diagnostics, Quintus 5-part hematology analyzer brings clinical value through an accurate and reliable performance. The analyzer is installed with an outstanding user-interface to ensure easy operations. The requirement of only three reagents greatly simplifies reagent logistics. The optional 100 sample autoloader offers high-throughput automation for laboratories with high workloads. Through sophisticated technologies, the analyzer provides results to aid in diagnostic decision making. It is therefore recommended to adhere to determined maintenance procedures and service schedules to ensure a consistent system performance.

Ordering information

Product	Product code	
	EU	US
Quintus 5-part analyzer	1600001	
Quintus autoloader	1091348	
Quintus 5-part Diluent, 20 L	1504291	501-292
Quintus 5-part Lyse, 5 L	1504292	501-291
Quintus 5-part Stopper, 1 L	1504373	501-350
Boule Hypochlorite 4.0% Cleaner, 100 mL	1504385	
Boule Con-5Diff G2 Tri-level, 6 × 3 mL	1504376	502-115
Boule Cal-5Diff G2, 1 × 3 mL	1504375	502-116
Boule Preventive Maintenance Kit	1200116_S	

Related literature	Product code
Brochure: Quintus 5-part hematology analyzer	BPQ32181
Quintus user manual	22648

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